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AN ACCOUNT
OF A NEW SEMI-METALLIC SUBSTANCE,
CALLED
MENACANE, AND ITS ORES,
BY THE LATE G. MITCHEL, M.B.

READ, JULY 4th, 1803.

SINCE the discovery of Menacane by Mr. Gregor, the distinguishing properties of the peculiar metallic substance it contains have been so fully developed, and satisfactorily ascertained, by the united exertions of Kirwan, Klaproth, Vauquelin and Lampadius, that little is left to wish for, so far as the chemical characters are concerned. As an object of natural history, it has, as yet, been little attended to. It is therefore hoped, the following attempt, to supply in some measure that deficiency, so far as the present data allow it, will prove acceptable to the naturalist. It is scarcely necessary to observe, that I follow Werner's method most exactly; as it is to him that we are indebted for the successful vindication of Mineralogy, as an independent province in the fœderal state of natural history; and which acknowledges, in Chemistry, the powerful and indispensable ally, not the imperious and arbitrary lawgiver.

Of the genus Menac we are already acquainted with five species or ores. It is, however, sufficiently probable, that several new species will, at no distant period, be added to the list; and that this metal is more widely distributed, and more generally diffused, and plays, perhaps, a more important part, than is at present suspected.

MENAC, GENUS.

Tribe of Rutile	1. Rutile. 2. Rutilite.
Tribe of Menacane	3. Nigrine. 4. Menacane. 5. Iserine.

FIRST SPECIES.

RUTILE.*

Titanite of Kirwan.
Rutil of Werner.
Sagenite of Saussure.

EXTERNAL CHARACTERS.

The colour varies from light hyacinth to dark brownish red. Is found crystallized.

1°. In

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* Probably the anatase of Hauy is a variety of Rutile.—R. J.

1°. In right angled four-sided prisms, acuminated by four planes, which are set on the lateral planes.

2°. In six-sided prisms, which are said sometimes to exhibit a tendency to a six-sided acumination.

3°. In acicular and capilliform crystals, whose regular shape is no longer determinable, and which are, moreover, strongly compressed.

The crystals are longitudinally sulcated, often very deeply; are commonly small, and very small, rarely middle sized. The acicular are often fascicularly aggregated: the capilliform crystals are often in a singular manner reticulated, the interstices forming equilateral triangles: exteriorly, shining and moderately glistening; interiorly, glistening; the lustre adamantine.

The principal fracture is foliated with a two-fold cleavage, cutting each other at right angles: the transverse fracture is imperfect and minute conchoidal.

The fragments are cubical.

It sometimes exhibits slender, columnar, distinct concretions.

Is usually translucent, sometimes only translucent at the edges.

Hard.

Brittle.

Gives a pale orange yellow streak.

Is easily frangible.

Heavy, in an inferior degree, about 4, 200.

OBSERVATIONS.

The larger crystals, particularly those from Hungary, are often curved, have frequent transverse rifts, are sometimes broken intirely across, the ends removed to some distance from one another, and the interstices filled up with the substance of which the matrix consists; sometimes two crystals meet under an angle more or less obtuse, and are joined like the corner of a frame. The crystals are, moreover, subject to great irregularities, are seldom fully crystallized, and, therefore, rarely acuminated; the four-sided prisms are often slightly rhomboidal; the six-sided prisms, from Hungary, are usually dilated, and seem composed of accumulated acicular crystals, from whence arise the columnar distinct concretions; the six-sided prisms, from France, are said to originate from the truncation of two opposite lateral edges of the four-sided prism; the capilliform crystals are sometimes coloured green, from chlorite earth. By some authors, this fossil has been said to resemble red silver ore; but the slightest acquaintance with the oryctognostical characters is sufficient to shew the difference; a geognostical character also furnishes us here with an easy means of distinguishing this fossil from other ores of a red colour. Rutile is generally of cotemporaneous formation with its associated fossils; whereas red silver ore, red orpiment, &c. being formed in veins, are always of later formation than the rock on which they are seated.

seated. Some systematic writers have confounded it with rubellite, with which it has scarcely two characters in common.

CHEMICAL CHARACTERS.

Without addition, or even with phosphoric salts, it is infusible by the heat of the common blow-pipe; with borax or alkali, it affords a hyacinth red transparent glass; with the heat excited by pure air, it gives a milk white bead, and suffers a considerable loss of weight. It is insoluble in the mineral acids, before it has been melted with alkali, but yields readily to acid of sugar; is precipitable by acid of galls with a bright red, and by prussian alkali with an handsome dark green colour. The method of analysis I shall omit, as belonging properly to mineralogical chemistry; the result has shewn that this fossil consists wholly of the calx of Menac.

GEOGRAPHIC DISTRIBUTION.

This fossil has hitherto been discovered in but few places, and in moderate quantity, principally near Rosenau in Upper Hungary; in Mount St. Gothard in Switzerland; in Fischthal in the high mountains of Saltzburg; near St. Yrieux in France; in the province of Burgos in Spain; in the forest of Speysart, near Aschaffenberg, in Franconia; at Beresooskoi in Siberia, and Olapian in Transilvania.

GEOGNOSTIC OCCURRENCE.

The Hungarian rutile is found imbedded in a kind of quartz, passing into rock crystal, and forming nests in mica slate; it is therefore of cotemporaneous formation with the rock in which it lies. That from St. Gothard in Switzerland occurs partly in those drusy cavities, which are not unfrequent in granific mountains of high antiquity, lying in or upon the rock crystal, adularia, and foliated chlorite, with which those cavities are lined, and partly dispersed through, or seated in, the scarcely perceptible clefts of one of those nameless chloritic rocks, which abound so much throughout the Alps in general. That from Aschaffenberg is said to occur in granite; that from Saltzburg is found imbedded in massive common tremolite. The rutile from Spain and Siberia is imbedded in rock crystal. It would therefore appear that this fossil lays claim to great antiquity, the time of its production falling within the period of the earlier primitive rocks, and that the metal it contains probably surpasses, in that respect, tin, molybdæna and tungsten, vieing even with iron and manganese.*

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* Von Buch has discovered rutile in layers of quartz, in clay slate (Thonschiefer), near Mühlbach in Saltzburg, in the vicinity of metallic layers, consisting of copper glance, copper pyrites, iron pyrites, nickel, and rarely native copper: also on the mountain Brennkogl, in the valley of Fusch; where it occurs in mica slate, either reticularly aggregated in rifts, or in acicular crystals, accompanied by those singular cylindrically aggregated crystals of foliated chlorite, in venules of almost coeval formation with the rock itself.—*Buch's Geognostische Beobachtungen.*——R. J.

The above description has been chiefly taken from an attentive examination of the specimens of rutile existing in the best collections of Vienna and Saxony.

SECOND SPECIES.

RUTILITE.

Calcareo-siliceous titan ore of Kirwan.
Titanit of Klaproth.

EXTERNAL CHARACTERS.

The colour varies from brownish red to dark reddish brown.

Has been hitherto found only crystallized in very rhomboidal four-sided prisms, acutely bevelled at the extremities, the bevelling planes set on the obtuse lateral edges. The crystals are small, and very small, seldom middle sized.

Exteriorly, they are shining. Interiorly, glistening, with a resinous lustre.

The fracture is imperfect and minute conchoidal, passing into the uneven.

The fragments are indeterminately angular, tolerably sharp edged.

Rutile has also been discovered by Von Humboldt, on the summit of a mountain near Caraccia, in New Granada, at the height of 1316 toises.—R. J.

The transparency varies, from translucent, through translucent at the edges, to opaque.

Is semihard, bordering upon hard.

Brittle.

Gives a greyish white streak.

Is easily frangible.

Not particularly heavy, approaching the heavy (3,500).

OBSERVATIONS.

The lateral planes meet alternately under angles of 135° and 45. From the foregoing fossil it is sufficiently distinguished by crystallization, fracture, inferior hardness, and specific gravity. From grenatite it may readily be discriminated, by the difference in crystallization, fracture, and sort of lustre.

CHEMICAL CHARACTERS.

Before the blow-pipe it suffers no change, nor in the heat of a porcelain furnace, when exposed in an earthen crucible; but in a crucible of charcoal it melts to an imperfect black glass, owing to the partial reduction of the metallic contents. With considerable difficulty, and only by repeated digestion, marine acid dissolves a third part of the weight of this fossil, consisting partly of the menac contents. Klaproth, from whom these characters are taken, found it to consist of nearly equal parts menac-calx, silex, and lime, to which Vauquelin joins a large portion of iron calx.

GEOGNOSTIC OCCURRENCE.

In the mountains of Passau, this fossil is found imbedded in a coarse granular aggregate of felspar and hornblende, and felspar and actynolite; therefore belonging to the genus green-stone, and order of primitive trap. In Norway it occurs in rocks belonging to the same formation, in which the celebrated layers of magnetic iron ore lie, and is associated with hornblende, and several individuals of a tribe not as yet sufficiently examined and described, but which evidently constitute middle links between actynolite and hornblende, and to which the names arendalite and acanticone have been applied. Near Dresden and Brünn it is found dispersed through sienite; and at Galway in Ireland, in an uncommonly beautiful porphyritic sienite. Hence it appears, that this fossil has only occurred in rocks belonging to primitive trap, or in sienite, the last crystallization which took place within the primitive period, and must therefore be considered as a later production than rutile. Here a consideration of the laws of crystallization countenances the observations on the order in which the primitive rocks follow one another. The rutile, consisting of few and simple elements of cotemporary origin, with a granite, in which rock crystal occupies the place of quartz, and adularia that of common felspar, sufficiently bespeaks a period, when the solution being purer and more tranquil, furnished an earlier and purer crop of crystals; while the confused and irregular

gular crystallization of primitive trap and sienite, together with the greater impurity of the felspar, and very compounded nature of the hornblende and rutilite, indicate an inferior purity of the solution, and, consequently, later precipitation of the crystallized mass.

THIRD SPECIES.

NIGRINE.

Nigrin of Werner.

EXTERNAL CHARACTERS.

The colour is dark brownish black, passing into velvet black.

Is found in larger and smaller angular grains, and pebbles.

Externally, moderately glistening. Internally, principal fracture is glistening; the transverse fracture moderately glistening.

Lustre, adamantine.

The principal fracture is imperfectly foliated, with a single cleavage; the transverse fracture is flat, and imperfectly conchoidal.

The fragments are indeterminately angular, and sharp-edged.

Perfectly opaque.
Semihard.
Brittle.
Gives a yellowish brown streak.
Heavy, in a moderate degree (4,500).

OBSERVATIONS.

This fossil is readily distinguished from menacane, by its stronger lustre and superior hardness, the colour of the streak, and by its not being in the least magnetic; which also sufficiently distinguishes it from iserine and iron sand.* Being found in company with fragments of rutile of a dark colour, the latter has by most been confounded under the same denomination; but the red colour of the rutile, joined to its perfectly foliated fracture, with a two-fold cleavage, intersecting each other at right angles, and the thence resulting cubical fragments, distinguish it sufficiently from nigrine.

The present description is taken from a specimen I had the pleasure of receiving from Professor Jacquine the younger, of Vienna.

CHEMICAL CHARACTERS.

The nigrine is infusible per se by the blow-pipe; but, with the assistance of borax, it melts to a transparent, hyacinth

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* Genuine iron sand must not be confounded with magnetic iron ore in a *sandy form*, which usually passes under that name.

cinth red bead: to acid of sugar, it readily yields its menac contents, which furnishes the characteristic precipitate of this genus. Klaproth and Lampadius have given us the constituent ingredients, 8 or 9 per cent. menac calx, and 2 or 1 calx of iron. It is probable, however, that the proportion of menac calx is over-rated; it appearing evident, from the description accompanying the analysis, that there had been no care taken to select the nigrine from the grains of rutile which accompany it.

GEOGNOSTIC OCCURRENCE.

The nigrine has been hitherto found only at Ohlapian, in Transylvania, in alluvial hills, consisting of yellow sand, intermixed with fragments and bowlders of granite, gneiss, and mica slate, and from which gold is obtained by washing. This gold is the purest found in Transylvania; a circumstance sufficiently indicating, that it belongs to a different, and, consequently, earlier formation, than the usual Transylvanian native gold, which occurs there in clay porphyry, grey wacce, and grey wacce slate, and belongs to the brass yellow variety, from the considerable alloy of silver which it contains. In these stream works, the nigrine is obtained at the same time with the gold, and comes to us intermixed with grains of rutile, oriental garnet, native iron, cyanite, and common sand; which renders it extremely probable, that this fossil, also, is a native of the primitive mountains.

FOURTH SPECIES.

MENACANE.

Menachanite of Kirwan.
Menacan of Werner.

EXTERNAL CHARACTERS.

Is of a greyish black colour, inclining somewhat to iron black.

Only met with in very small, flattish, angular grains, which have a rough, glimmering surface.

Internally, moderately glistening, with adamantine lustre, passing into the semi-metallic.

The fracture is imperfectly foliated, approaching to the slaty.

The fragments are indeterminately angular, and sharp-edged.

Perfectly opaque.

Is soft.

Brittle.

Retains its colour in the streak.

Easily frangible.

Heavy, in a moderate degree (4,427).

OBSERVATIONS.

This fossil has been said, but erroneously, to have much resemblance to iron sand, from which it may be easily distinguished by the fracture, lustre, and inferior specific gravity.

PHYSICAL AND CHEMICAL CHARACTERS.

Menacane is attractable by the magnet, but much more weakly than iron sand, or magnetical iron ore; it is infusible by the common blow-pipe, or heat of a porcelain furnace, exposed in a coal crucible, but melts, when in contact with a clay one; it also melts quickly to a black bead, before a blow-pipe animated by pure air. The menac contents may be easily extracted by digestion with acid of sugar. Klaproth and Lampadius, about the same time, have shewn, that it consists of nearly equal parts menac and iron calces.

GEOGNOSTIC OCCURRENCE.

This fossil has hitherto been only found, accompanied by fine quartz sand, in the bed of a rivulet, which washes the valley of Manachan, in Cornwall. The neighbouring mountains belong to the primitive order, in which, most probably, the menacane formerly constituted a superficial layer; but, by their decomposition, and consequent degradation,

dation, by means of rains and floods, the earthy parts have been carried off, and the heavier metallic fragments collected in the valley.

FIFTH SPECIES.

ISERINE.

Iserin of Werner.

EXTERNAL CHARACTERS.

The colour is iron black, inclining a little to brownish black.

Is found in small, obtuse, angular grains, and in pebbles, with a somewhat rough, strongly glimmering surface.

Internally, it is shining, with semi-metallic lustre.

Fracture is more or less perfectly conchoidal.

Fragments are indefinitely angular, and sharp-edged.

Perfectly opaque.

Hard.

Brittle.

Retains its colour in the streak.

Is heavy, in a moderate degree (4,500).

OBSERVATIONS.

Of all fossils, this has the strongest resemblance to iron sand; into which, as Mr. Werner first observed, it actually graduates, but may be distinguished from it by the shade of brown in its colour; by its superior external, and inferior internal lustre; by its less specific gravity; but, chiefly, by being only slightly, and that by a powerful magnet, attractible. From nigrine and menacane, it differs sufficiently in fracture and lustre. This, as well as nigrine, was first considered as a particular species by Werner; both which determinations were afterwards confirmed by the analysis.

CHEMICAL CHARACTERS.

As in the foregoing species, the menac calx may here be readily extracted by acid of sugar, the residuum being dissolved in aqua regia: on the addition of tartarised tartarin, a lemon yellow powder falls to the bottom, which is tartarised menac; what remains in the solution is iron. Lampadius, to whom we owe the analysis, found that menac and iron are here in a decreasing proportion; the latter amounting to about 20 per cent. A late experiment has shewn him, that iron sand contains the same principles, but, probably, in an inverted proportion.

GEOGNOSTIC OCCURRENCE.

Hitherto this fossil has been only found in the high Riesen mountains, which separate Silesia from Bohemia, near the origin of the Iser, dispersed through the granitic sand which forms the bed of that river. To what order of rocks it owes its origin is uncertain; but its near affinity to iron sand, which is exclusively an inmate of the flötz trap formation, and the certainty, that this formation was formerly superstratified, at a great elevation, on the Riesen mountains, (as the remains, which form the Buchberg,* and occupy the Schneegruben, sufficiently testify,) render it highly probable, that this fossil, also, may belong to that formation; and, consequently, dates its origin from a much more recent period, than the foregoing species of this genus.†

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* The Buchberg (which I enjoyed the invaluable opportunity of examining with my excellent and ever to be regretted friend) is the highest basalt hill in Germany, being 2921 feet above the level of the sea, and the highest basalt, except that small quantity lodged in the cavity of the Schneegruben, which is some hundred feet higher. The hill itself is elevated about 500 feet above the Iser, that washes its granitic basis, and the Iserine is found at some distance below. We could, indeed, discover no trace of it in the basalt of the present hill.—R. J.

† Mr. Gregor (as stated in Nicolson's Journal) has found, that menac is one of the constituent ingredients of basalt; a fact, which adds much to the plausibility of Dr. Mitchell's very ingenious supposition.—R. J.

GENERAL REMARKS.

These are the only fossils of this genus, with whose characters we are as yet sufficiently acquainted to say, with certainty, that they form distinct species. Between the three latter and iron sand, the intermediate transitions, as between all adjacent fossils, are, probably, innumerable. Were we to take analysis alone for our guide, it would multiply the species without necessity, and lose sight of the intentions of nature, who does not confine herself to 5 or 10 per cent. of an ingredient: beside, a Klaproth has confessed, that it is not so much the identity and proportion of the ingredients, as the particular state of their combination, (which to us is perfectly unknown,) that determines the nature of the resulting fossil. In addition to those fully determined species, we have been favoured, by Klaproth, with the analysis of a menacaniferous ore, from Aschaffenberg; by Vauquelin, with that of another, from Bavaria; and, by Abildgaard, with that of a third, from Barboe, in Norway; all which differ from the foregoing species, and from one another, in composition, or in the proportion of ingredients; so that it is impossible to determine, with any probability, to what species they belong, from the want of an adequate external description, and account of their geognostic occurrence.

The masterly hand of Klaproth has further detected this metal, in the iron sand, which accompanies the hyacinths, &c. in Ceylon, and in some of the iron ores of Norway; and

and Lampadius has lately discovered it, in the iron sand of Hohenstein, near Stolpen, in Saxony, and in that found with the pyrope of Bohemia. Besides these, I have seen, in the imperial cabinet, at Vienna, and some few private collections, ores, said to come from Stiria or Carinthia, and from Bohemia, in which the menac calx probably abounded; as may be conjectured, from the strong shade of brown in the colour, together with the considerable adamantine lustre, both which are strongly characteristic of this genus.

The use of this metal is, as will readily be supposed, from its scarcity, and the newness of its discovery, very confined. The rutile, indeed, was, for a length of time, employed to give a brown colour, in the porcelain manufacture of Sevres, near Paris; but, from the difficulty of communicating an equal tint by it, has been since abandoned. The rock crystal, inclosing capilliform crystals of rutile, has been employed as a setting for rings. The precipitates, especially those from acid of sugar, may be employed as water colours; that, by acid of galls, affording a good tile red, and that, with Prussian alkali, an agreeable dark green. The latter, also, communicates a durable colour to silk, as my friend, Lampadius, assures me; perhaps, with proper management, it might be employed to furnish the so much wished for durable green for the printing of cotton. And, lastly, its close connection with some iron ores, and those exactly of the most superior quality, such as the ores of Norway and Stiria, leads naturally to the suspicion, that it may possess some favourable influence upon the manufacture of iron, and, therefore, well deserves the attention of future enquirers. Such are the principal circumstances, at present known, respecting this genus of fossils: time will, doubtless, here, as usual, find much to amend, to correct, and to supply.